

REMARKS

In the Office Action of May 10, 2006, the Examiner withdrew claims 12-60 from consideration. The Examiner rejected claims 1-11 for obviousness-type double patenting over United States Patent No. 6,683,129 to *Eknoian*. Claims 1, 2, and 3 were rejected under 35 U.S.C. § 102(e) as anticipated by United States Patent No. 6,423,804 to *Chang et al.* Claims 5, 6, 8, and 10 were rejected as being unpatentable under 35 U.S.C. § 103(a) over '804 *Chang et al.* in view of United States Patent No. 3,547,847 to *Levine et al.* Claim 11 was rejected under § 103(a) over '804 *Chang et al.* in view of United States Patent No. 3,432,455 to *Rasicci*.

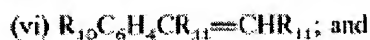
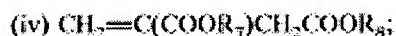
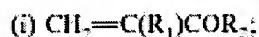
A terminal disclaimer has been filed herewith for the above mentioned '129 *Eknoian* patent. Also included is a *Declaration* under 37 C.F.R. § 1.132 by *Rajeev Farwaha*, stating that the art of record is not remotely suggestive of the salt-sensitive emulsion polymers of the present invention. Accordingly, this case is believed to be in condition for allowance.

The present invention is directed to salt-sensitive *emulsion* copolymers which include an acid monomer and at least one comonomer. As stated in the pending application, the polymers are useful for application to nonwoven fabrics or paper, among other applications, and retain good wet strength in the presence of salt solutions, yet remain dispersible in water. Claim 1, representative of the claimed subject matter, is reproduced below:

1. An aqueous emulsion comprising a water-dispersible copolymer which is non-dispersible in aqueous solutions containing 0.5% or more of an inorganic salt, wherein the water-dispersible copolymer comprises in percentages by weight:

(A) from about 10% to about 90% of an acidic ethylenically unsaturated monomer; and

(B) from about 10% to about 90% of an ethylenically unsaturated monomer selected from the group of monomer formulas consisting of:



wherein R_1 is hydrogen or methyl and R_2 is $-\text{OZ}'$ or $-\text{N}(\text{Z}'')(\text{Z}''')$, wherein Z' is an alkyl group having from 1 to 7 carbon atoms, and Z'' is independently selected from the group consisting of hydrogen and alkyl groups having from 1 to 6 carbon atoms; R_3 and R_4 are independently hydrogen or an alkyl group having from 1 to 7 carbon atoms, with the proviso that R_3 and R_4 are not both hydrogen; R_5 is hydrogen or methyl and R_6 is an alkyl group having from 1 to 7 carbon atoms; R_7 and R_8 are independently hydrogen or an alkyl group having from 1 to 7 carbon atoms, with the proviso that R_7 and R_8 are not both hydrogen; R_9 is an alkyl group having from 1 to 7 carbon atoms; R_{10} and R_{11} are hydrogen; R_{12} and R_{13} are independently selected from the group consisting of hydrogen, $-\text{CN}$, $-\text{NHCHO}$, $-\text{NHCOCH}_3$, and an alkyl group having from 1 to 7 carbon atoms; and the copolymer has a weight average molecular weight greater than about 25,000 and is present in an amount from about 20% to about 70%.

Accordingly, the polymers used in the present invention include (A) an acidic ethylenically unsaturated monomer; and (B) an additional ethylenically unsaturated monomer selected from certain groups. As stated in paragraph 0046 of the pending application, by carefully selecting the amount and type of monomers, emulsion copolymer products can be provided which impart wet strength in the presence of salt, but become dispersible in water.

Turning to the anticipation rejections, the Examiner rejected claims 1, 2, and 3 over the '804 *Chang et al.* reference. These rejections are clearly improper because the *Chang et al.* reference in no way teaches or discloses salt-sensitive *emulsion* resins. In contrast to the salt sensitive emulsions of the invention which are polymerized in an aqueous medium in the presence of surfactants and/or colloids, the polymers used in *Chang et al.* are solution polymerized polymers. As stated in the *Chang et al.* reference at col. 4, line 57+:

The ion-sensitive polymers of the present invention may be prepared according to a variety of polymerization methods, preferably a solution polymerization method. Suitable solvents for the polymerization method include, but are not limited to, lower alcohols such as methanol, ethanol and propanol; a mixed solvent of water and one or more lower alcohols mentioned above; and a mixed solvent of water and one or more lower ketones such as acetone or methyl ethyl ketone.

See, also, col. 6, line 66 through col. 7, line 7 of *Chang et al.* where it is noted that the binder resin may be dissolved in solution prior to application to the substrate:

For ease of application to the fibrous substrate, the binder may be dissolved in water, or in a non-aqueous solvent such as methanol, ethanol, acetone, or the like, with water being the preferred solvent. The amount of binder dissolved in the solvent may vary depending on the polymer used and the fabric application. Desirably, the binder solution contains up to about 25 percent by weight of binder composition solids. More desirably, the binder solution contains from about 10 to 20 percent by weight of binder composition solids.

Additionally, whereas emulsion polymers are frequently characterized by their particle size (*see, e.g.,* pending application at paragraph 0047), the *Chang et al.* reference is silent with respect to particle size and only characterizes the size of the polymer by molecular weight. *See, e.g., Chang et al.* at col. 4, lines 53-56.

Furthermore, *Chang et al.* endorses the use of the AMPS modified polymers of those described in US Patent No. 5,317,063 and US Patent No. 5,312,883, both assigned to the Lion

Corporation, which are attached hereto as **Exhibits 1 and 2**, respectively. See, *Chang et al.* col. 4, lines 35-38, and examples 1-9. As can be seen in **Exhibit 1** at col. 4, line 43+ and **Exhibit 2** at col. 3, lines 36+, the salt-sensitive polymers described therein are polymerized in solvents such as acetone, methanol, ethanol, or propanol. Thus, the '063 and '883 Lion patents are not even remotely suggestive of salt-sensitive emulsion polymers.

Representative examples from each of the Lion patents are reproduced below to further illustrate that the *Chang et al.* patent uses solution polymerization processes to produce salt-sensitive polymers which are highly soluble in water. Note, the Examples in *Chang et al.* are merely AMPS-modified versions of the Lion solution polymers described below.

5,317,063

EXAMPLE 1

To a 500 ml four-necked separable flask provided with a stirring machine, a reflux condenser and a tube for introducing nitrogen gas, there were added 80 g of acrylic acid, 20 g of benzyl acrylate, 150 g of acetone and 35 g of deionized water for forming a uniform solution and then nitrogen gas was introduced into the flask through the nitrogen gas-introducing tube with stirring. After 20 minutes, there was added, to the solution, a solution of a polymerization initiator obtained by dissolving 0.1 g of 2,2'-azobis(2-amidinopropane) dihydrochloride in 5 g of deionized water to initiate the polymerization reaction in a water bath maintained at 70° C. The system was polymerized at 70° C. for 6 hours in a nitrogen gas stream, then cooled to room temperature and neutralized by adding a mixed solution comprising 4.6 g of a 48% aqueous solution of sodium hydroxide (rate of neutralization=5 mole % with respect to the acrylic acid), 60 g of deionized water and 240 g of ethanol. The solid content of the resulting polymer solution as determined by a Kett moisture meter was found to be 16.1% and the polymer had a weight-average molecular weight of 370,000.

About 3 g of this polymer solution was poured into a region which was defined by enclosing a part of the surface of a polyethylene plate placed on a horizontal base with silicone rubber and which had a size of 10 cm square, allowed to stand under constant temperature and humidity conditions of 25° C. and 50% RH for 2 days to form a film. The thickness of the resulting film varied depending on every portions to be determined, but fell within the range of from 35 to 50 μ m.

5,312,883

EXAMPLE 1

55 g of acrylic acid, 15 g of 2-ethylhexyl acrylate, 30 g of butyl acrylate, 106 g of acetone and 38 g of distilled water were fed in a 500 ml four-necked separable flask provided with a stirrer, reflux condenser and nitrogen-introducing tube to obtain a homogeneous solution. Then nitrogen gas was introduced into the flask through the nitrogen-introducing tube under stirring. 20 minutes after, a solution of a polymerization initiator prepared by dissolving 0.88 g of 2,2'-azobis(2-amidinopropane) dihydrochloride in 5 g of distilled water was added to the resultant solution to initiate the polymerization reaction under heating in a water bath maintained at 70° C. After conducting the polymerization at 70° C. for 6 hours in nitrogen gas stream, the reaction mixture was cooled to room temperature and then neutralized by addition of 7.65 g of 48 wt. % aqueous sodium hydroxide solution and 380 g of distilled water (neutralization rate: 12 molar % based on acrylic acid; weight-average molecular weight: 300,000). The solids content of the resultant polymer solution as determined with a Kett moisture meter was found to be 15.5%.

Accordingly, the *Chang et al.* reference teaches to use water soluble solution polymers, as opposed to water dispersible (*i.e.*, not totally soluble) emulsion polymers that are the subject of the present invention. Indeed, the *Chang et al.* reference does not even mention the word "emulsion."

The difference between emulsion polymers and solution polymers, particularly in salt-sensitive applications, is critical. As stated in the pending application at page 9, line 14 +, solution polymers have a vastly different mechanism of film forming and dispersion in water, as compared to emulsion polymers. Moreover, solution polymers require divalent ion inhibitors to achieve successful salt-sensitive properties in the presence of hard water, while emulsion polymers do not. The relevant portion of the pending application, which distinguishes solution polymers, is reproduced below:

[0047] Unlike conventional water-soluble polymers, the aqueous emulsions of the present invention do not require divalent ion inhibitors. Film formation of latexes differs from film formation of solution polymers since particle coalescence is needed to form a film of high cohesive strength in emulsion polymers. For solution polymers, particle coalescence is not necessary because the solvent acts as a plasticizer which aids in the film formation by allowing polymer chains to mix and entangle. For emulsion polymers, the cohesive strength of the polymer film is reduced if the particles do not fully coalesce because of the reduction of chain entanglements. For emulsion polymers, the surface active layer remains as an interfacial boundary between particles and prevents full chain entanglement to the extent observed from solution polymers. As a result, films derived from the aqueous emulsions of the present invention will readily disperse in the presence of water. In addition, the novel polymer film will also disperse in hard water since divalent ions do not inhibit the redispersability by the film derived from emulsions. In contrast, for polymer films derived solution, hard water is less effective in solubilizing the polymer since divalent ions inhibit the movement of the highly entangled polymer chains. For films derived from solution polymers, ion regulating agents are required to enhance the solubilization in hard water. This is the main reason why the aqueous emulsions of the present invention do not require a divalent ion inhibitor (sequestering agent) to aid in the redispersability in tap water, especially hard water. Preferably the particle size of the water-dispersible copolymer is from about 0.05 micron to about 0.8 micron.

The use of emulsion polymers is highly preferable to solution polymers, because emulsion resins are typically solvent free, have lower viscosities than solutions, and are more stable over long periods of time, *i.e.*, they are resistant to phase separation. See, paragraph 0048 of the pending application (referring to US Patent Application Publication No. 2004/0186222). Emulsion polymers have the further advantage that they may be formulated at a higher solids level and, thus, shipped less expensively. Additionally, unlike solution polymers, the salt-sensitive emulsions of the present invention are preferred from an environmental perspective because they do not contain significant amounts of organic solvents. See, *Declaration* at ¶ 9.

Salt-sensitive emulsion polymers are not remotely suggested by the *Chang et al.* patent and, indeed, it is unexpected that emulsion resins can be made to have salt-sensitive functionality. The salt-sensitive properties of the inventive compositions are surprising, because the polymers used in the invention are usually at least somewhat insoluble in water. Thus, it is unexpected that films made from these inventions would readily disperse upon contact with water. See, *Declaration* at ¶ 7 where Rajeev Farwaha states:

7. That the salt-sensitive properties achieved by the emulsion resins are unexpected because the emulsion polymers used are usually at least somewhat insoluble in water, yet can be produced in a way such that films (or the like) formed from the emulsion readily disperse in water, without the resin completely dissolving. For example, the emulsion polymers disclosed in the examples of the present invention comprise monomers such as methacrylic acid, ethylhexyl acrylate, and butyl acrylate; polymers containing monomers such as vinyl acetate and monooctyl maleate are also disclosed. These emulsion polymers are relatively insoluble in water, yet are made to be dispersible in tap water and non-dispersible in salt solutions, as is seen in the table in the pending application at p. 59. This behavior is surprising as one of skill in the art would not expect that resins which are insoluble enough to exist as stable emulsions, would form films which are readily dispersible in water.

Accordingly, a person of ordinary skill in the art would not expect to successfully produce a salt-sensitive polymer by emulsion polymerization.

Additionally, as stated in ¶ 8 of the *Declaration*, it is further unexpected that the polymers remain dispersible in hard water, because references which employ solution resins, such as those in *Chang et al.*, teach that the inclusion of sulfonated monomers is needed to improve hard water dispersibility. See, *Chang et al.* at col. 3, line 62 through col. 4, line 4; and col. 5, lines 18-37. As can be seen in Table 2 of the *Chang et al.* reference, the AMPS-modified solution polymers remain soluble in hard water (200 ppm), but become insoluble with calcium ion concentrations of 1,000 ppm.

The issue at hand in this case was also raised in copending application number 09/883,520, where the Examiner cited another Kimberly-Clark patent to make a similar rejection—US Patent No. 6,444,214 to *Cole et al.* which also discloses the use of solution polymerized salt-sensitive resins. **Exhibit 3**, attached herewith, includes a December 19, 2005 Office Action in the '520 application where the Examiner sustained the rejection over the *Cole et al.* reference. **Exhibit 4** is an April 26, 2006 Office Action, where it can be seen that the Examiner withdrew the rejection over *Cole et al.* after a request for reconsideration in which the differences between solution polymerized resins and the emulsion resins used in that case were explained.

Regarding the § 103 rejections of claims 5, 6, 8, 10 and 11 over *Chang et al.* in view of *Levine et al.* or *Rasicci*, the proposed combinations do not meet the claim elements for the reason stated above and, in any event, there is not a proper motivation to combine the references with *Chang et al.* For example, the *Levine* reference is related to an emulsion resin which improves the adhesion characteristics of paints on exterior surfaces. The Examiner stated that it would be obvious to combine the monomers in *Levine* with the resins in *Chang et al.* “to provide desirable compositions or improved adhesion to both chalky and glossy painted surface.” However, the *Levine* resin relates to an emulsion resins which are fundamentally different from solution polymers in composition and preparation, and has different film forming characteristics than solution resins. Indeed, a person of ordinary skill in the art would not consider the

technical problems of emulsions resins as particularly relevant to solution polymers. Also, absent any suggestion in the art to use salt-sensitive emulsions in paint compositions, the proposed motivation is pure hindsight—in contrast to the binders of the invention, paint compositions are generally formulated so that a paint coating does not disperse upon contact with water.

The *Rasicci* reference also lacks any motivation to combine the references. The *Rasicci* patent likewise relates to emulsion polymerized resins which are useful in paint compositions, dipped goods, coatings, etc. According to *Rasicci*, low viscosity emulsions with large particle sizes can be produced if specific surfactants with divalent metal cations are used. Here again, there is no motivation to combine the references because the *Chang et al.* reference relates to solution polymers, which do not typically include surfactants. Regarding the motivation to combine, the Examiner cites a portion of *Rasicci* which states that its compositions provide “improved polymer lattices.” The suggested motivation ignores the fundamental difference between the references, is ambiguous, and does not describe the nature of a problem to be solved such that a person of ordinary skill in the art would be motivated to make the combination. See, MPEP § 2143.01. Accordingly the combination of the *Chang et al.* references with either *Levine et al.* or *Rasicci* is improper.

The double patenting rejections advanced by the Examiner are resolved by the terminal disclaimer filed herewith.

For the reasons above, and in view of the enclosed *Declaration of Rajeev Farwaha*, the pending claims are believed to be in condition for allowance. References such as *Chang et al.*, which relate to solution polymers, are not at all suggestive of salt-sensitive emulsion polymers of the present inventions.

This response is believed timely filed. If any additional extensions or fees are necessary, please consider this a *Petition* therefore and charge any fees to Deposit Account No. 50-0935.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read 'A. Webb', with a long horizontal flourish extending to the right.

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